Gao L, Maidment I, Matthews FE, Brayne C, CFAS.

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Title: Medication usage change in older people (65+) in England over 20 years: Findings from CFAS I and CFAS II

Lu Gao [a], Ian Maidment [b], Fiona E Matthews [a], Louise Robinson [c], Carol Brayne [d], on behalf of the Medical Research Council Cognitive Function and Ageing Study

Mrs Lu Gao
[a] MRC Biostatistics Unit, Cambridge Institute of Public Health, Cambridge, UK
e-mail: lu.gao@mrc-bsu.cam.ac.uk

Dr Ian Maidment
[b] School of Life and Health Sciences, Medicines and Devices in Ageing Cluster Lead, Aston Research Centre for Healthy Ageing (ARCHA), Aston University, Birmingham, UK
e-mail: i.maidment@aston.ac.uk

Professor Fiona E Matthews
[a] MRC Biostatistics Unit, Institute of Public Health, Cambridge, UK & Institute of Health and Society, Faculty of Medicine, Newcastle University, Newcastle, UK
e-mail: fiona.matthews@mrc-bsu.cam.ac.uk

Professor Louise Robinson
[c] Institute of Health and Society, Faculty of Medicine, Newcastle University, Newcastle, UK
e-mail: a.l.robinson@newcastle.ac.uk

Professor Carol Brayne
[d] Department of Public Health and Primary Care, Cambridge Institute of Public Health, Cambridge, UK
e-mail: cb105@medschl.cam.ac.uk

Correspondence to: Carol Brayne cb105@medschl.cam.ac.uk Tel: +44 01223 330321

Alternate correspondent: Lu Gao lu.gao@mrc-bsu.cam.ac.uk Tel: +44 01223 330392

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Medication usage change in older people (65+) in England over 20 years: Findings from CFAS I and CFAS II

ABSTRACT

Background Medical practice has changed over the last decades reflecting the ageing population, when multi-morbidity requiring multiple medications is more common.

Objective Describe and quantify self-reported medicine use including both prescription and over the counter medicines in two comparable population-based studies of older people (65+) in England and to assess the nature and scale of polypharmacy.

Methods Data used were from two separate population-based studies; the Cognitive Function Ageing Study I and II. Descriptive analyses were performed to summarize and quantify general medicine use. Negative binomial regression models were fitted to determine factors associated with the number of medicines used.

Results Medication use, including both prescribed medicines and over the counter products has increased dramatically over the last two decades. The number of people taking 5 or more items quadrupled from 12% to 49%, while the proportion of people who did not take any medication has decreased from around 1 in 5 to 1 in 13. Cardiovascular drugs were the most frequently taken medication. Polypharmacy is associated with increases in the number of diagnosed long term conditions.

Conclusions Comparison between CFAS I and II reveals marked increases in medication usage and polypharmacy in the older population. The influence of healthcare organisation, introduction of new guidelines and technology changes leading to diagnosis of earlier, milder chronic diseases and treatment may be contributing to this changing pattern. Further research is needed to develop practical solutions to optimise medication management in older people, reducing the harming associated with medication.

INTRODUCTION

Over recent decades medical practice has changed dramatically. Evidence from randomised controlled trials and awareness of potential benefits have led to an array of treatment opportunities. Such evidence has been incorporated into guidelines for primary care, sometimes with incentives. Prescribing practices in primary care settings have been transformed, and management of long term chronic conditions is increasingly shifting from secondary care to general practitioners. Increasing life expectancy is partly due to better treatment, and upstream primary prevention through reduction of risk factors [1].

National policy has also strongly influenced the management of chronic illnesses. In England for example through the Quality Outcomes Framework (QOF), primary care clinicians are financially rewarded for the provision of structured, evidence-based long term condition (LTC) management [2]. This alongside the introduction of prescribing guidance by National Institute for Health and Care Excellence (NICE) has influenced prescribing practice. In parallel with this there have been changes to the availability of over the counter (OTC) medications and the rules governing those who have authority to prescribe certain medications, in particular nursing staff and community pharmacies [3] [4] . Both phenomena have led to increased direct public access to medications.

Across the developed world, the population is ageing. Older people tend to take more medications leading to polypharmacy [5], usually defined as the concurrent use of 5 or more medications, such polypharmacy, if not properly managed, may be associated with potential adverse outcomes [6]. Although there is evidence of prescriptions changing over time, there is little knowledge about the medications taken by the older population on a day-to-day basis, how this has changed over time and whether the policy and practice changes outlined above have influenced prescribing practice.

AIMS AND OBJECTIVES

This paper aims to understand changes in the nature and pattern of medication use amongst people aged ≥65 in England in two comparable population-based studies; Cognitive Function and Ageing Study I (CFAS I,1991-1994), and Cognitive Function and Ageing Study II (CFAS II, 2008-2011).

Our objectives were to:

1) describe and quantify self-reported medicine use including prescription and OTC medicine;

2) compare and identify changes in patterns of the medication use within the same age and gender groups between CFAS I and II;

3) investigate the factors associated with medication use over time.

METHODS

Study population

Detailed description of CFAS studies has been published elsewhere [7], but briefly CFAS I and CFAS II are two multi-centre population-based studies investigating cognition and health in older people, they use the same sampling method, population approach and interviews and were conducted approximately two decades apart. Participants were randomly selected people aged ≥65 living in community and institutions from three centres in England (Cambridgeshire, Newcastle and Nottingham).

Data collection

Both studies, collected data through face-to-face interviews conducted in participants' place of residence using a structured, computer assisted interview with direct data entry. The baseline interview included, basic socio-demographics, living status, information on functional impairment, health conditions and health related data (e.g. self-rated health and medication).

Medication use

Participants were asked: "Are you currently taking any medicines, tablets or injections of any kind, either you buy yourself or are prescribed by your doctor?", If answered "Yes", details of medicines were recorded include name, dosage, frequency and quantity. Vitamins and mineral supplements and OTC medications were included. Medication data were classified according to Read Codes and Application Dictionary (READ), which are the standard clinical terminology system used in UK General Practice.

Long term condition (LTC)

Participants were asked to rate their self-perceived health as "Excellent/Good/Fair/Poor". The self-reported LTCs included in this analysis are listed in Appendix 1.

Statistical analysis

Descriptive analyses were performed to summarize and quantify medicine use in CFAS I and II. A negative binomial regression was fitted to test which factors may affect medication use as the distribution of outcome variable (count of medicines used) in the study appeared to be skewed. Factors known to influence medication use including age, gender, social class, living status (care setting or in community), number of LTC and study cohort (CFAS I or CFAS II) were included as independent variables in the regression model, collinearity was assessed. All analyses were weighted using inverse probability for sampling design and non-response. Stata 12.1 was used for data analysis.

RESULTS

Of the 7,635 people recruited in CFAS I (participation rate 81.7%), the medication data were available for 96.4% (n=7,359). In CFAS II, a total of 7,762 people were recruited (participation rate 54.7%) with 98.1% (n=7,614) provided medication data (Appendix Fig 1).

In CFAS I over 15,000 items were recorded with nearly 99% codable using READ, with medication/OTC class and sub-class (98.7%). The maximum number of medicines taken by any respondent was 8 items; the median number in those taking at least one medicine was two. In CFAS II, over double the number of items was

recorded with over 99% codable using READ (99.5%). The maximum number of medicines taken by an individual was 23 items, the median medication use was four. The modal number of medicines shifted from one in CFAS I to three in CFAS II. Fig 1 shows the number of commonly used medications by drug classes.

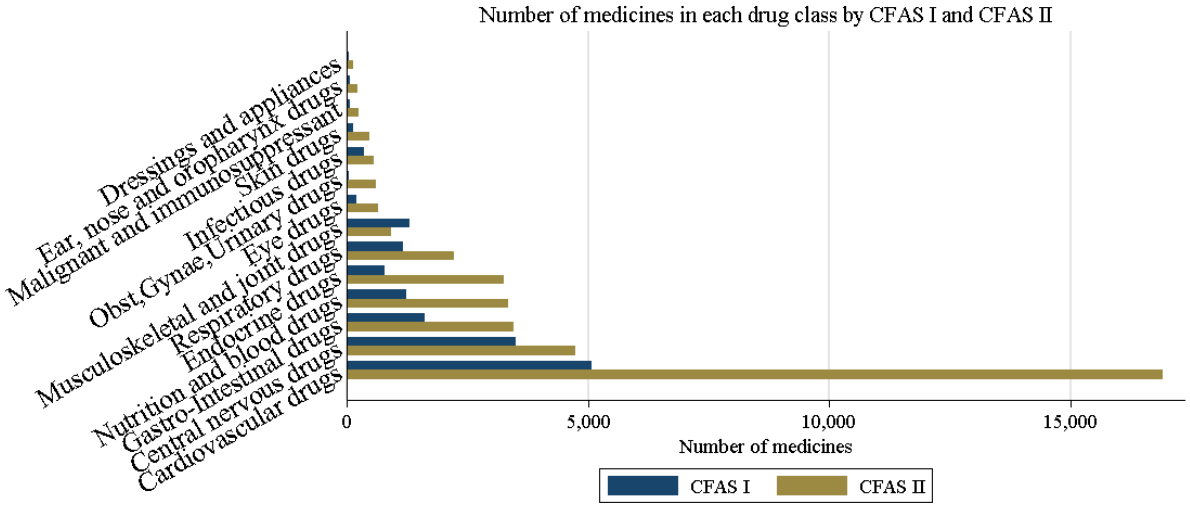
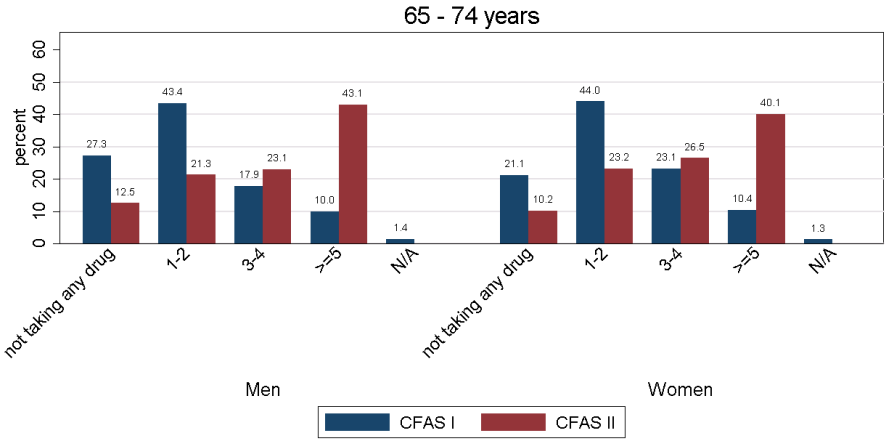


Fig 1

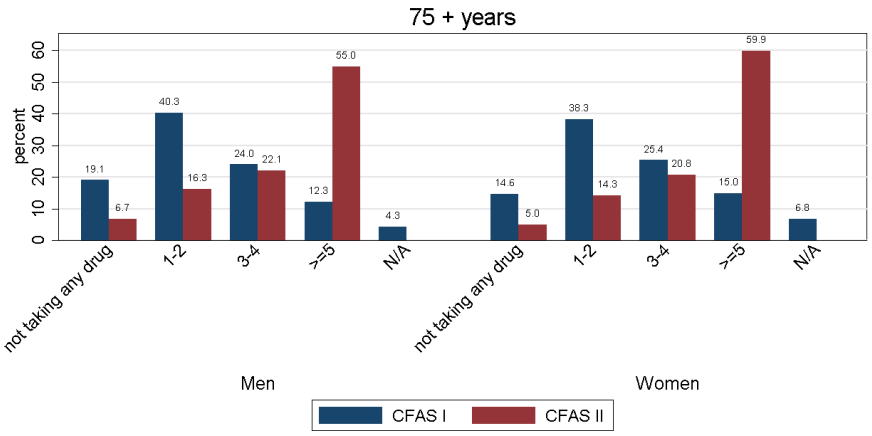
Cardiovascular drugs were the most frequently used drugs in both studies; they contributed 33% and 47% of all drugs taken in CFAS I and CFAS II respectively, they also accounted for the largest increase with an additional 230% taken in CFAS II. This was mainly driven by the subclasses “lipid lowering drugs”, “antiplatelet drugs”, and “ACE inhibitors”. Medications in the endocrine class and nutrition/blood drugs showed a dramatic increase of over three fold (310%) with thyroid hormones being the major contributor. Nutrition/blood drugs increased by 170%, mostly due to an increase of Vitamin A, D and other OTC supplements. “Calcium and vitamin D medication” increased 32 fold from an almost non existent, “Obst/Gynae/Urinary drugs” increased 16 fold (including 220 anti-cholinergics). Increases were also seen in “gastro-intestinal drugs” (115%), “respiratory system drugs” (89%) and “central nervous drugs” (35%) in CFAS II whereas “musculoskeletal and joint drugs” decrease by 40% (see appendix Fig 2 for sub-class details).

Further data is provided in Appendix Table 1. Many more people reported 3 or more LTCs in CFAS II compared with CFAS I. Hypertension, diabetes, asthma, thyroid problem, angina, and heart attack being those significantly more frequently reported in CFAS II (appendix Table 2). Slightly more people reported “Excellent” and “Good” health in CFAS II (CFAS II: 70% vs. CFAS I: 67%).

The number of people taking ≥5 drugs increased from approximately 1 in 8 (12.2%, CI 95%: 11.5% - 13.0%) in CFAS I to nearly 1 in 2 (49.6%, CI: 48.5% - 50.8%) in CFAS II. Far fewer people were in the 'no medication' category, decreasing from 1 in 5 (19.9%, CI 95%: 19.0% - 20.8%) in CFAS I to 1 in 13 (7.8%, CI 95%: 7.2% - 8.4%) in CFAS II. Fig 2 a) and b) provide the age and gender profiles, with differences in all but different magnitudes.



a) Medication use (%) in CFAS I and CFAS II in 65 - 74 age group by sex



b) Medication use (%) in CFAS I and CFAS II in 75 + age group by sex

Fig 2

Results from the regression model (Appendix Table 3) showed that age, number of LTCs and living in a care setting are strongly associated with increased use of medication. A centre difference emerged with Nottingham having 10% less use than Cambridge. Manual workers took more medication than those from professional and managerial occupations. After adjustment for other factors, CFAS II participants took more than double the medications than those in CFAS I.

DISCUSSION

Findings from these unique population-based studies of people aged ≥65 reveal dramatic increase in the total amount of medication over two decades. The proportion of people not taking any medication more than halved. Equally dramatic is that the proportion of people taking 5 or more items quadrupled from 12% to 49%.

Strengths and weaknesses

A key strength of this study is the comparability of medication use between two population-based studies with identical design, sampling methods and sample population from the same geographical locations, two decades apart. In addition, data included all the medicines that participants reported they took either prescribed or bought over the counter.

However there are limitations to our study. The non-participation rate was higher in CFAS II , but this has been extensively explored in earlier analyses and is addressed through inverse probability weighting to adjust for non-response [7]. Self-reported data generally has limitations, though these can be countered though careful design and application of self-reported measures. In CFASs, to increase the accuracy of the reporting, interviewers requested, where possible, to see the medicines, and checking whether the medicine is taken as prescribed (as instructed for OTC medicines) before entering data. Further more, we lack separate data on OTC usage and how many medicines are supplied by the hospital.

These findings are comparable to data available on medication use in the community in the UK and globally. Scotland has seen the mean number of drugs dispensed increase from 3.3 in 1995 to 4.4 in 2010. The proportion of adults dispensed ≥5 drugs doubled to 20.8% [8], this increase was also observed in a US study which found 29% of patients in the age range 57 to 85 years were receiving 5 or more concurrent prescriptions [9]. In Italy between 2000 and 2010 the number of people aged ≥65 years prescribed five or more active agents rose from 43% to 53% [10].

The observed increases in polypharmacy are to be expected as life expectancy increases and multi-morbidity rises. Such increases are likely to have been influenced by significant changes in the organisation of health systems in England over the study time period. Changes include a transfer of LTC management to primary care accompanied by programmes such as QOF which have resulted in earlier diagnosis, more proactive treatment and regular reviews of people with LTCs, in addition, national prescribing guidance for individual disorders have been introduced [11]. Notwithstanding such changes, the prevalence of some common chronic diseases in the UK, such as diabetes, have increased over time [12] also mirrored in our findings with increases in reporting of diabetes (by 8.0%), hypertension (by 20.0%), heart conditions (by 4.1%). It is likely that these rises are driven by a combination of earlier detection, changed service approaches as well as potential increases in the underlying conditions themselves. Earlier diagnosis may have an impact on improving older peoples' health and quality of life although there is concern about overdiagnosis and overtreatment [13]. Our data show that although the reported number of LTC increased in CFAS II alongside polypharmacy, self-rated health has slightly improved, this is could be explained by the more proactive disease detection and care leading to better controlled management of LTCs.

The establishment of NICE in 1999 was a major change in clinical care in the UK [14]. Subsequent unified sets of national evidence-based guidance for the management of, and prescribing in individual LTCs are likely to have had a much greater impact than previous guidelines (which tended to be local trust guidance). In 2008, NICE published its guidance on lipid modification in primary and secondary prevention of cardiovascular diseases and type 2 diabetes [15], recommending that people with a 20% or greater risk of developing CVD in the next 10 years be offered statin drugs in order to prevent CVD. Evidently a large increase in statin use was seen in CFAS II. The 2006 NICE guideline for hypertension advocated a three-drug combination of an ACE inhibitor plus a calcium-channel blocker plus a thiazide-type diuretic [16]. Falling CVD mortality rates over past ten years in the UK are thought partly to be due to better early treatment [17] and such guideline is likely to explain the large increases in the use of cardiovascular medicines found in this analysis. Our findings also show a dramatic increase in Proton pump inhibitors (PPI). Those people taking PPIs as well as at risk of osteoporosis are recommended by NICE to maintain an adequate intake of calcium and vitamin D [18]. Of PPI users in CFAS II, 12% were also taking vitamin D, a clear example of cascade prescribing.

Polypharmacy in older people if not managed properly, is associated with considerable harm from the side-effects of medication and prescribing errors through to increased mortality and non-adherence [19]. Whilst our data confirm a considerable increase in polypharmacy we are unable to comment on the appropriateness, of such increased drug use. Potentially inappropriate prescribing (PIP) is common in older people [20] particularly in vulnerable groups such as those with dementia [21] , those at end of life [22] and is associated with increased morbidity, mortality and hospital admissions [23].Our analysis also identified an increase in the use of anti-cholinergic drugs. Such drugs are associated with a significant risk of cognitive impairment in a population already at higher risk of developing cognitive impairment [24].

Our findings have implications for future practice and service delivery. The QOF programme, like most clinical guidance on LTC management, targets a single disease. Guidelines are often dense and inflexible [25]; thus it is likely that clinicians who have limited consultation time, will prescribe focused on a single disease, rather than addressing the 'norm' of multi-morbidity, potentially leading to unnecessary prescribing and adverse effects. A more sophisticated approach to prescribing guidelines and LTC management is needed to help clinicians adopt a more patient-centred and holistic care approach to LTC management, particularly for high risk groups [26]. In clinical practice, it is essential to ensure that practical strategies, such as regular medication review and de-prescribing including the use of drug holidays become part of usual care [27] [28]. Appropriate medication review is one aspect of medicines optimisation recommended in prescribing guidelines [29]. A validated tool, such as the Screening Tool of Older Person's Prescribing (STOPP/START) and Beer' Criteria [30] may also provide an effective and practical method to balancing the benefit/harm of multiple medications for elderly people.

CONCLUSION

The CFAS studies show a marked increase in medication usage and polypharmacy in people aged ≥ 65 in the last twenty years and reflect our ageing populations where multi-morbidity is now the norm. These findings highlight the need for robust evidence about benefits and harms in the context of multi-morbidity as well as the need for regular medication review to become 'usual care' for older people especially those at high risk. Deeper exploration of these trends, benefits, harms and costs could facilitate practical solutions to optimise prescribing, reduce harm and the ever increasing cost of medications.

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Appendix 1

Long term condition (LTC)

The self-reported long term conditions (LTC) included in this analysis are angina, hypertension, diabetes, stroke, heart attack, epilepsy, chronic bronchitis, asthma, arthritis, peptic ulcer, pernicious anaemia, Parkinson's disease, and thyroid problems and if present whether the condition was diagnosed by a GP or a specialist.

Table 1: Description of the population of CFAS I & II and the profile of medication use within each category

		Proportion within each category*		Profile of medication use (%) [&]							
				CFAS I				CFAS II			
		CFAS I	CFAS II	0	1 - 4	>=5	missing	0	1 - 4	>=5	missing
Age	65 – 74	48.0	45.7	23.9	64.5	10.3	1.4	11.0	45.6	42.0	1.7
	75 +	52.0	54.3	16.2	63.7	14.1	6.0	5.2	34.4	56.0	4.4
Gender	Men	39.2	43.9	23.6	62.6	11.1	2.8	9.1	39.9	48.5	2.6
	Women	60.8	56.1	17.5	65.0	13.0	4.5	6.7	39.2	50.5	3.6
Social class	Professions/managerial/technical worker	25.4	23.6	21.0	66.7	11.0	1.3	11.0	42.9	44.0	2.1
	Non-manual skilled worker	11.8	23.8	21.0	66.3	10.8	1.9	8.0	40.6	49.6	1.8
	Manual skilled worker	39.2	26.8	19.2	65.8	13.0	2.0	7.5	38.9	51.3	2.3
	Partly skilled/unskilled manual worker	20.6	18.8	20.7	62.9	14.0	2.4	5.0	37.2	54.9	2.9
	Not classified	3.0	7.0						0		
Education	<=8 years	8.2	3.7	19.3	61.9	14.9	3.8	7.7	35.0	51.7	5.6
	9 – 10 years	72.5	60.5	19.9	65.6	12.2	2.3	6.1	38.0	53.1	2.8
	>=11 years	16.8	34.3	21.4	64.9	12.1	1.6	11.1	43.7	44.0	1.3
	N/A	2.4	1.4		0				0		
Live in an institution	No	94.9	96.7	20.1	65.9	11.8	2.2	7.9	40.4	48.9	2.8
	Yes	4.6	3.3	15.8	37.1	17.8	29.4	3.4	13.0	70.4	13.3
Self-reported health	Excellent	17.7	19.4	38.6	57.3	3.8	0.4	18.1	52.9	27.5	1.5
	Good	49.0	50.7	21.6	69.7	7.0	1.7	8.0	45.8	44.8	1.5
	Fair	25.9	23.9	9.1	67.1	21.7	2.1	1.9	26.5	69.7	2.0
	Poor	6.5	6.1	4.6	52.0	39.5	3.9	0.8	10.0	87.6	1.7
Number of LTC	0	18.8	13.6	50.0	46.7	1.6	1.6	36.4	54.2	8.6	0.8
	1	30.3	25.4	23.4	70.1	4.8	1.8	11.2	58.8	28.8	1.2
	2	23.8	26.9	10.6	77.3	11.0	1.1	3.4	48.5	47.2	0.9
	3	13.3	17.5	5.1	70.4	23.2	1.3	1.4	27.6	69.9	1.2
	4 +	12.8	16.7	2.1	57.8	38.9	1.2	0.2	11.9	87.1	0.8
Centre	Cambridgeshire	34.9	30.2	20.7	63.0	14.4	1.9	8.2	42.7	46.5	2.5
	Newcastle	32.5	34.5	18.4	64.4	12.4	4.8	5.7	34.4	56.3	3.8
	Nottingham	32.6	35.4	20.5	64.8	9.9	4.9	9.4	41.7	45.8	3.1
Total				19.9	64.1	12.2	3.9	7.8	39.5	49.6	3.2

*: Percentage in each characteristic category
[&]: Percentage by number of medication category

Table 2: Percentage people with a long term condition in CFAS I and CFAS II

Long Term Condition	CFAS I %	CFAS II %	χ^2 Test P value
Angina	13.3	16.1	<0.01
Intermittent claudication	1.5	1.5	0.82
Heart attack	9.8	11.1	0.02
Hypertension	30.1	52.3	<0.01
Stroke	7.5	8.2	0.10
Diabetes	6.2	14.4	<0.01
Epilepsy	2.1	2.2	0.74
Asthma	8.4	13.7	<0.01
Arthritis	52.8	53.5	0.40
Chronic bronchitis	14.6	11.6	<0.01
Thyroid problem	7.3	12.8	<0.01
Peptic ulcer	10.2	8.5	<0.01
Pernicious anaemia	2.7	2.8	0.76
Parkinson's disease	1.1	0.8	0.16

Table 3: A comparison of medication use within the populations and across time

		Count of medicine use	
		IRR*	95% CI
Age (years)	64 – 69	1	
	70 – 74	1.11	1.07 – 1.15
	75 – 79	1.18	1.14 – 1.22
	80 – 84	1.25	1.21 – 1.30
	85 – 89	1.27	1.20 – 1.32
	90 – 94	1.32	1.22 – 1.43
	95 +	1.36	1.11 – 1.67
Gender	Men	1	
	Women	0.99	0.97 – 1.02
Social class	Professional, employers and managers	1	
	Non-manual workers	1.03	0.99 – 1.06
	Skilled manual workers	1.05	1.01 – 1.08
	Semi-skilled and unskilled manual workers	1.05	1.01 – 1.09
Live in an institution	No	1	
	Yes	1.40	1.27 – 1.53
Number of LTCs		1.27	1.26 – 1.28
Centre	Cambridgeshire	1	
	Newcastle	1.01	0.98 – 1.04
	Nottingham	0.91	0.88 – 0.93
Study	CFAS I	1	
	CFAS II	2.10	2.05 -2.15

*IRR: incident rate ratio, for example 90 – 94 year old take medication 36% more than 64 -69 year old

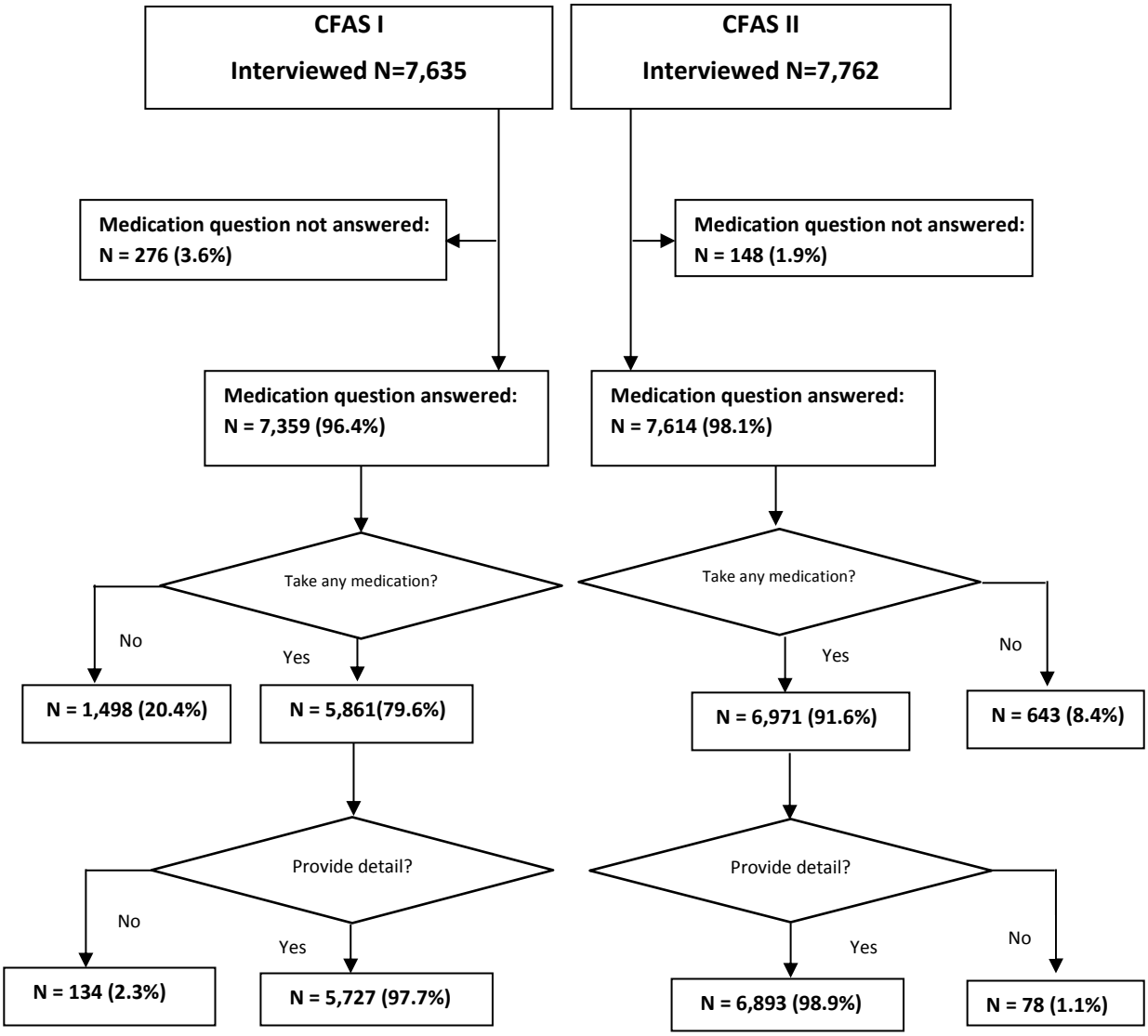

Fig 1: medication data collection flow diagram

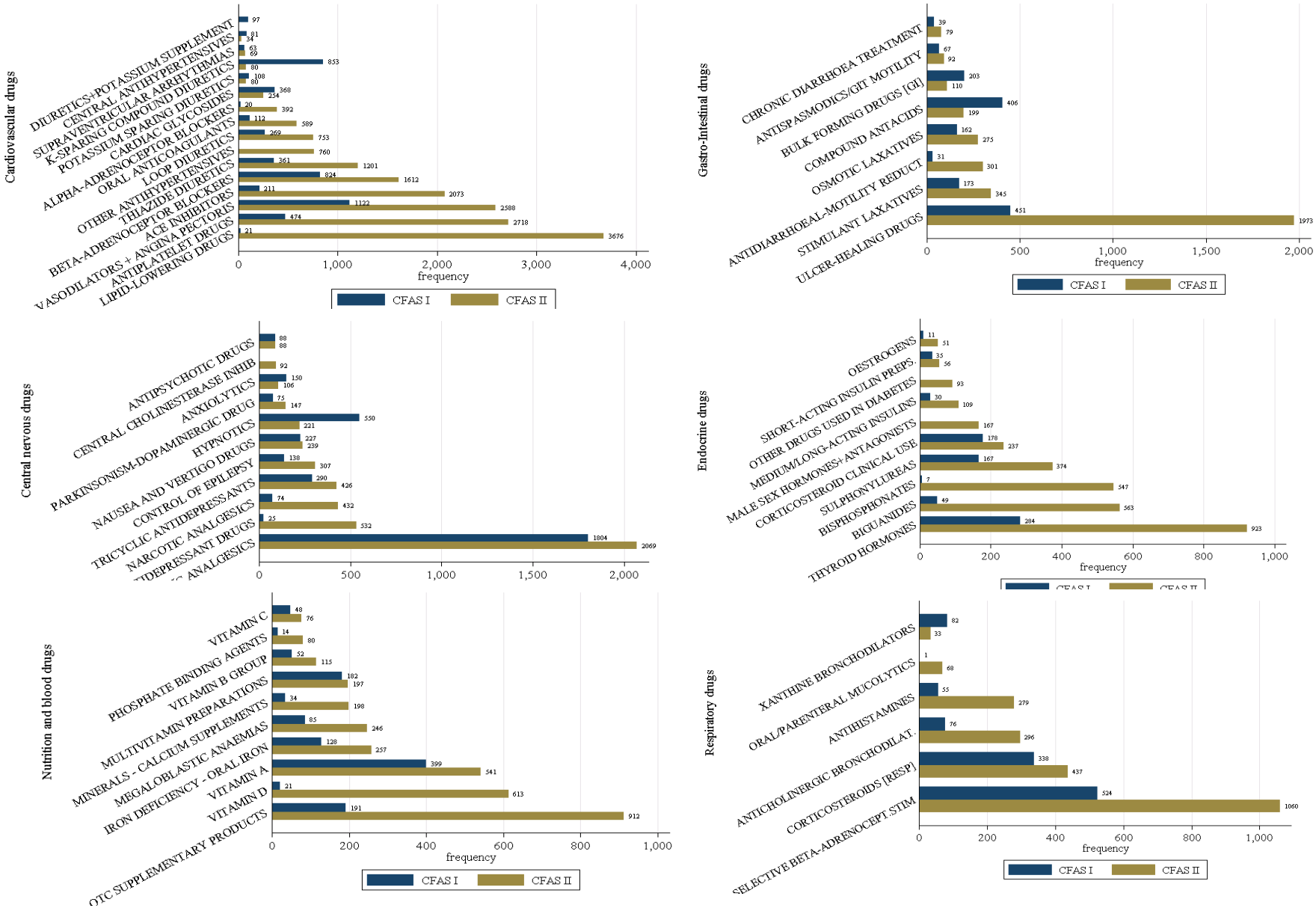

Fig 2: Frequencies of sub-class drugs of common used drugs